at least the larger of these cells produced sperms, and asociated bodies, probably representing sperms, were also found.

The author concludes that an integument of free segments is more primitive than that of "coalesced" segments, and that probably intermediate stages of coalescence occur in the Lagenostoma group. In this group, therefore, the origin of the integument is multiple, but the nature of the units is the residual question. OLIVER is not inclined to accept Miss BENSON'S suggestion that the integument (as illustrated by that of *Lagenostoma Lomaxii*) has arisen by the sterilization of the peripheral sporangia of a synangium; but prefers to regard it as a new structure, arising contemporaneously with the seed habit, and related in some way to the "encasement" that so often accompanies reproductive activity.

The reasons for regarding Physostoma as a member of the Lagenostoma group are given in detail, and the conclusion is reached that it is the "most primitive seed yet come to light," the plant to which it belongs probably being one of the Lyginodendreae. The reasons for the conclusion quoted above are not quite clear, and seem to contradict some rather convincing conclusions reached by the same author in his study of Stephanospermum and other paleozoic seeds.—J. M. C.

**Sterility in hybrids.**—TISCHLER[6] has a lengthy treatment of the subject of sterility in hybrids. A preliminary paper, summarizing his conclusions, has already been reviewed in this journal.[7] The present paper is in two parts, the first presenting the cytological data and the second dealing with the theoretical conclusions. The use of charcoal in drawings can scarcely be recommended for clearness, many of the figures being mere smudges, and they furnish no sufficient evidence of such cytological matters as the pairing of threads in synapsis. Pollen formation, and in some cases megaspore formation, is described in hybrids of Mirabilis, Potentilla, and Syringa. A variety of irregularities, such as are common during the reduction divisions in hybrids, are described, including formation of extra nuclei by chromosomes left in the cytoplasm and failure of one or both reduction mitoses. In other cases the reduction processes were normal, but there was a lack of cytoplasm and the pollen grains failed to grow. *Potentilla rubens*, cultivated in dry and hot conditions, matured good pollen, but after fertilization the young embryos died. In all cases a paucity of cytoplasm was observed, beginning during or after reduction.

TISCHLER concludes that the cause of sterility is not any lack of harmony between the chromatic elements. However, it seems necessary to assume some "incompatibility" of the chromatins or plasms, which makes itself evident during the formation of reproductive cells, for otherwise there is no explanation why a plant continues to show vegetative growth and yet fails to mature its germ cells. Instead of a chromosome incompatibility, perhaps we may have in the

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[6] TISCHLER, G., Zellstudien an sterilen Bastardpflanzen. Arch. Zellforschung **1**:33–151. *figs. 120.* 1908.

[7] BOT. GAZETTE **45**:68. 1908.

cytoplasm some process which is symbolized by the pairing of chromosomes in synapsis, and which, owing to differences in the composition of the parental idioplasms, leads to derangement and finally cessation of the metabolism that had previously been carried on successfully. Some such hypothesis is necessary to explain why failure of growth usually begins with germ cell formation, and the necessity is not lessened by the fact that sterility is a purely relative phenomenon produced also by other conditions than hybridization.

TISCHLER agrees with JOST that the increased luxuriance of some hybrids is probably due to a "poisoning" effect of one species on the other. Some of the cases of self-sterility bear a similar interpretation.

Three classes of facts are cited to show that there is not a segregation of characters during reduction in Mendelian hybrids: (1) Cases of vegetative splitting, as in *Syringa correlata* and *Cytisus Adami*. (2) Certain cases of latency or cryptomery (TSCHERMAK); e. g., the crossing of two white forms having certain other characters gives a violet hybrid. But such cases have been otherwise explained by the Mendelians. (3) Characters mendelize which cannot be represented by distinct portions of the idioplasm. Here are cited annual and biennial races of *Hyoscyamus niger*, immunity and non-immunity to rust in certain grains, and sterility and non-sterility in Lathyrus. On the other hand, it might be said that if the chromosomes are unlike, then each must represent some general property of the whole organism, if it represents anything. TISCHLER concludes that in the reduction divisions there is not a true segregation but latescence (*Latentwerden*) of characters. It is questionable whether this is an improvement over the idea of chromosomes or representative particles in the dominant and recessive condition in the germ cells, a hypothesis which will undoubtedly have to be given up. *Drosera rotundifolia* × *longifolia* produces pollen grains in tetrads, and in some cases two grains of a tetrad have characters belonging to each parent. This indicates a splitting of characters during reduction. But BATESON crossed races of Lathyrus having long and round pollen, in which all the $F_1$ had long pollen and the $F_2$ gave long: short in the ratio 3:1. From this it appears that it is possible to have Mendelian behavior without segregation of characters during reduction.

The frequent sterility in mutants, accompanied by similar irregularities to those in hybrids during reduction, as the reviewer has shown,[8] TISCHLER also ascribes to some disturbance of the idioplasm.—R. R. GATES.

**Temperature and growth.**—Beginners in research will do well to study this paper by BALLS.[9] It is of a type really too rare. It shows how a keen scientific discernment is alert to appreciate the significance of a casual observation in its bearing upon a fundamental problem. It shows how difficulties may be overcome

[8] GATES, R. R., Pollen development in hybrids of *Oenothera lata* × *O. Lamarckiana*, and its relation to mutation. BOT. GAZETTE **43**:81–115. *pls. 2–4.* 1907.

[9] BALLS, LAWRENCE W., Temperature and growth. Annals of Botany **22**:557–591. 1908.